black- or plumbeous-coloured forms, examples of which I have seen from Mentone.

Olivaceus, var. nov.

Various shades of olive-green. Figured by Pollonera (*op. cit.*). I have examined specimens from Mentone.

Flavo-griseus, var. nov.

Yellowish grey. Foot-fringe usually lighter than the body. From Mentone.

It is difficult to separate some forms of *olivaceus* from this variety.

On the Mechanism of the Production of Light in Orya barbarica *of Algeria.* By M. Raphael Dubois.

The discovery of the photogenous faculty in the Algerian *Orya barbarica* is of relatively recent date. This fine Geophilid was observed for the first time, in a luminous condition, almost at the same moment by M. Raphael Blanchard at El Kantara (April 1888) and by M. J. Gazagnaire at Nemours (May 1888).

Moreover, a certain number of important peculiarities were mentioned by M. Gazaignaire *; the phosphorescent substance is exuded from pores situated upon the sternal and episternal plates in the form of a viscid yellowish fluid, with an odour *sui generis*, drying rapidly on exposure to the air and insoluble in alcohol.

In September 1887, on observing some specimens of *Scolioplanes crassipes* which had been sent to me from La Fère (Aisne) by M. Huet, I had myself remarked that the luminous fluid was excreted from the ventral surface of the body, contrary to an opinion which I had previously advanced; but I had not published this observation, since I intended to complete it later on. As I was unable to obtain fresh examples of *Scolioplanes*, I went to Algeria to look for specimens of *Orya barbarica*.

Not only have I verified the accuracy of the facts recorded by M. Gazagnaire, but I have been able especially, thanks to the employment of the microscope, of which this investigator did not avail himself, to make new observations which confirm in the most precise manner the correctness of the definitive theory of the mechanism of the production of light, as set forth in my last work on *Pholas dactylus* †.

The facts which I have already recorded in various communications are correct, but their interpretation has sometimes varied in consequence of new discoveries; to-day, however, uncertainty can no longer exist, owing to the facility for observation and experiment

* J. Gazagnaire, "La phosphorescence chez les Myriopodes" (Bulletin de la Société Zoologique de France, t. xiii. p. 182).

† R. Dubois, 'Anatomie et Physiologie comparées de la *Pholade dactyle*.' Paris, G. Masson, 1892.

afforded by *Orya barbarica*, in which the luminous substance is secreted by special organs and can be collected in a state of purity.

This substance is formed in pyriform, unicellular, hypodermic glands, measuring from eight to ten hundredths of a millimetre in length and from five to six in breadth. In sections one hundredth of a millimetre thick, stained with methylene blue or hæmatoxylin, there can be distinguished in the granular protoplasm of the gland numerous rounded or ovoid droplets, which are met with again in the excreted matter. These droplets, which have been considered by observers in the case of other luminous animals to be of a fatty nature, do not turn black when treated with osmic acid, and exhibit the histo-chemical characters of protoplasm or of condensed albuminoids. Immediately after their contact with the atmosphere a very refringent spot is observed to arise at their centre; they then possess the form which caused me to bestow on these little bodies, which are found in all luminous organs, the name "*vacuolides*." This refringent point becomes the centre of a crystal, or, rather, of a group of crystals. The protoplasmic matter excreted thus passes from the colloidal to the crystalloidal condition under the eyes of the observer, while the light is produced. After a certain time the preparation is entirely filled with magnificent groups of crystals in the shape of ferns, or arranged in long fasciculate prismatic needles.

Contact with the air is necessary and stimulates the luminosity, but contact with water is no less essential.

This is due to the fact that the phenomenon is not merely one of oxidation, for if the matter be rubbed between the fingers or dried the light speedily disappears; but the substance is capable of regaining all its brilliancy on being moistened with a little water. Moreover the excretory product is *distinctly acid*, which confirms the inaccuracy of Radzizewski's hypothesis, which sought to explain animal photogeny as being due to a slow oxidation in an alkaline medium.

Oxygen permits the respiration of the protoplasmic corpuscles passing from the colloidal to the crystalloidal condition, that is to say, from life to death. This respiration is really active only in protoplasm suitably hydrated, and water is necessary in order that the crystallization may take place under conditions favourable for the emission of light. The oxygen serves to produce the crystallizable substance with the assistance of water, and the water enables the photogenous crystallization to take place.

It was these two successive conditions of the photogenous matter that formerly led me to believe that there were two distinct substances reacting one upon the other.

In reality there are only two successive stages of one and the same substance, which is modified by oxygen and water, and for which I shall retain the name *luciferin* until it has been possible to determine its atomic structure.—*Comptes Rendus*, t. cxvii. no. 3 (July 17, 1893), pp. 184–186.